NOISE ASSESSMENT CRITERIA IN LAND USE PLANNING

PUBLICATION LU-131

MAY 1997

Ministry of
Environment
and Energy

ISBN 0-7778-4914-4

NOISE ASSESSMENT CRITERIA

IN

LAND USE PLANNING

PUBLICATION LU-131

MAY 1997

Cette publication technique
n'est disponible qu'en anglais.

PIBS 3372E

Noise Assessment Criteria in Land Use Planning
Publication LU-131

October 1997

This document replaces Publication NPC-131 "Guidelines for Noise Control in Land Use Planning", of the "Model Municipal Noise Control By-Law, Final Report, August 1978".

PURPOSE

This guideline outlines the position of the Ministry of the Environment (MOE) on noise criteria for planning of sensitive land uses, in support of the Provincial Policy Statement under the *Planning Act* and in accordance with the Ministry of the Environment Guideline D-1 "Land Use Compatibility". It is intended for use in planning of noise sensitive land uses adjacent to facilities such as but not limited to airports, road and rail transportation corridors, industrial facilities, aggr egate facilities, major commercial facilities, sewage treatment facilities, and waste sites.

In order to achieve effective and economical planning, the principles described in this document should be implemented early in the planning process. The purpose is to avoid problems in a proactive manner through input into the land use planning process. This guideline pertains to the mandate and the responsibilities of the MOE under its existing legislation, namely the Environmental Protection Act (EPA) and the Environmental Assessment Act (EAA). Other agencies, such as the federal government and municipalities, may have requirements over and above those of this MOE guideline.

TABLE OF CONTENTS

TABLE OF CONTENTS - ANNEX

LIST OF TABLES

1. GENERAL

1.1 SCOPE

This Publication defines criteria for noise impact assessment of proposed residential or other noise sensitive land uses located in Class 1 and Class 2 Areas (Urban). The Publication also specifies procedures for the establishment of sound levels on the site of proposed noise sensitive land uses due to transportation sources (road, rail and air traffic) as well as stationary sources (such as industrial and commercial activities). Acceptable noise control measures are enumerated.

Responsibilities for achieving the sound level criteria that ensure a comfortable living environment are assigned. Guidance in the form of good planning criteria and procedures is provided for development of noise sensitive land uses adjacent to industrial or commercial activities.

The guidelines in this Publication are intended to assist this Ministry, and provide direction to municipalities, planning boards and consultants on the requirements of the MOE in land use planning where noise is a factor. The Publication includes an Annex, which provides additional details, definitions and rationale for the assessment criteria in the context of general planning goals and principles. Furthermore, the Annex contains supplementary noise criteria which are presented as guidance for information purposes.

1.2 IMPLEMENTATION

1.2.1 Implementation by MOE

The MOE will implement the guidelines in this document by providing comments to relevant agencies on development applications and planning documents that are circulated to the MOE under the Planning Act, as specified in Reference [15].

1.2.2 Municipal Implementation

This Publication is intended to assist municipalities in the preparation of official plans, official plan amendments, comprehensive zoning by-laws, rezonings, plans of subdivisions, plans of condominiums, and other applications under the Planning Act.

1.2.3 Technical Procedures

More specific information on the technical implementation procedures, including details of noise impact assessment methods and control measures are contained in Reference [1] and in other publications listed in Section 1.4. Reference [16] provides information regarding the use of warning clauses.

1.3 RESPONSIBILITY

It is the developer's responsibility to ensure that the applicable sound level criteria are met. These responsibilities include the following:

(a) determining feasibility of the project including constraints applicable before any project action is taken or construction commitment is made;
(b) assessing outdoor and indoor acoustical environments;
(c) ensuring that the required control measures are incorporated in the development.

The required control measures should be specified in an agreement with the municipality.

If the noise impact results from a stationary source, it is the developer's responsibility to investigate feasible means of impact mitigation. The preferred mitigation option is a reduction of noise emissions at the stationary source by modifying the design or the operation of the source, or by implementing noise control measures directly at the sources. In that case, a cooperative effort on the part of the developer and the stationary source owner is desirable.

The control measures that are required as a result of mitigation at the site of a stationary source should be specified in a separate agreement between the developer and the owner of the stationary source.

1.4 REFERENCES

Reference is made to the following publications:

[1] Noise Assessment Criteria in Land Use Planning: Requirements, Procedures and Implementation, Ontario Ministry of the Environment, May 1997.

[2] Manual for Noise Assessment in Land Use Planning, Ontario Ministry of the Environment, 1997.

[3] ORNAMENT, Ontario Road Noise Analysis Method for Environment and Transportation, Technical Document, Ontario Ministry of the Environment, ISBN 0-7729-6376, 1989.

[4] STEAM, Sound from Trains Environmental Analysis Method, Ontario Ministry of the Environment, ISBN 0-7729-6376-2, 1990.

[5] Planning Act, Government of Ontario.

[6] Environmental Protection Act, Government of Ontario.

[7] NPC-101 - Technical Definitions, part of Reference [12].

[8] NPC-102 - Instrumentation, part of Reference [12].

[9] NPC-103 - Procedures, part of Reference [12].

[10] NPC-104 - Sound Level Adjustments, part of Reference [12].

[11] NPC-205 - Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban).

[12] Model Municipal Noise Control By-Law, Final Report, August 1978, Ontario Ministry of the Environment.

[13] Provincial Policy Statement, Ontario Ministry of Municipal Affairs and Housing, ISBN 0-7778-6020-1, February 1, 1997.

[14] Guideline D-6, Compatibility between Industrial Facilities and Sensitive Land Uses, Ontario Ministry of the Environment, July 1995.

[15] Guideline D-1, Land Use Compatibility, Ontario Ministry of the Environment, July 1995.

[16] Bulletin No. 91003, Environmental Warnings/Restrictions, Ontario Ministry of Consumer and Commercial Relations, July 25, 1991.

2. DEFINITIONS

"Adverse effect"
means one or more of the following effects of sound and vibration, selected from the relevant definitions in the Environmental Protection Act, Reference [6]:

- impairment of the quality of the natural environment for any use that can be made of it;
- harm or material discomfort to any person;
- an adverse effect on the health of any person, and
- loss of enjoyment of normal use of property.

"Ambient sound level"
means Background sound level;

"Background sound level"
is the sound level that is present in the environment, produced by noise sources other than the source under impact assessment. Highly intrusive short duration noise caused by a source such as an aircraft fly-over or a train pass-by is excluded from the determination of the background sound level;

"Class 1 Area"
means an area with an acoustical environment typical of a major population centre, where the background sound level is dominated by the urban hum.

"Class 2 Area"
means an area with an acoustical environment that has qualities representative of both Class 1 and Class 3 Areas, and in which a low ambient sound level, normally occurring only between 23:00 and 07:00 hours in Class 1 Areas, will typically be realized as early as 19:00 hours.

Other characteristics which may indicate the presence of a Class 2 Area include:

- absence of urban hum between 19:00 and 23:00 hours;
- evening background sound level defined by natural environment and infrequent human activity;
- no clearly audible sound from stationary sources other than from those under impact assessment.

"Class 3 Area"
means a rural area with an acoustical environment that is dominated by natural sounds having little or no road traffic, such as the following:

- a small community with less than 1000 population;
- agricultural area;
- a rural recreational area such as a cottage or a resort area; or
- a wilderness area.

"Construction", "Conveyance"
refer to the Annex.

"Control measure"
refers to action which can be taken to achieve compatibility for the specific land use or activity. The control measure should be permanent in nature and not be readily removable or alterable by the future occupants. Control measures may include, but are not limited to, the following:

- Acoustical Barriers - berms, walls, favourable topographical features, other intervening structures;
- Architectural Design - room and corridor arrangement, blank walls, placement of windows, balconies, and courtyards, building height;

- Building Construction - acoustical treatment of walls, ceilings, selection of acoustical materials and other control devices. Provision for air conditioning;
- Mitigation at Source - noise control applied directly to the noise source;
- Site Planning - orientation of buildings and Outdoor Living Areas with respect to noise sources, spatial separation such as the insertion of noise insensitive land uses between source and receiver, appropriate setbacks, and the use of intervening service roads;
- Windows/Doors - acoustically designed windows or doors that provide the required noise reduction. In order to allow for the windows and doors to remain closed, air conditioning, i.e. mechanical ventilation and climatic control system, is necessary.

Refer to References [1] and [2] for further description of control measures and their application.

"dBA"
means the A-weighted sound pressure level.

"dBAI"
means the A-weighted sound pressure level of an impulsive sound measured with a sound level meter set to "impulse" response.

"Indoor sound level"
is an estimated sound level in the central part of a room.

"L_{eq} (T): L_{eq} (16), L_{eq} (8), L_{eq} (1)"
means the A-weighted level of a steady sound carrying the same total energy in the time period T as the observed fluctuating sound. The time period T is given in hours.

"Ministry"
means the Ontario Ministry of the Environment.

"NEF/NEP"
means Noise Exposure Forecast/Noise Exposure Projection contours for major Ontario airports.

"Noise"
means unwanted sound.

"Noise sensitive land uses"
mean the following sensitive land uses:

- residential developments;
- seasonal residential developments;
- hospitals, nursing/retirement homes, schools, day-care centres, etc.

Sensitive land use means a land use that is sensitive in accordance with the definition of Reference [15], and that must be planned and/or designed using appropriate land use compatibility principles.

"Outdoor Living Area"
is the part of an outdoor area easily accessible from the building and designed for the quiet enjoyment of the outdoor environment. Outdoor Living Areas include, but are not limited to, the following:

- Backyards or front yards or gardens or terraces or patios;
- Balconies, provided they are the only Outdoor Living Areas for the occupant and meet the following conditions:

(a) minimum depth of 4 m;
(b) outside the exterior building facade;
(c) unenclosed;

- Common Outdoor Living Areas associated with multi-storey apartment buildings or condominiums;
- Passive recreational areas such as parks if identified by the municipality.

"Point of Reception"
means any point on the premises of a person where sound or vibration originating from other than those premises is received, see Reference [12].

"Stationary Source"
means a source of sound which does not normally move from place to place and includes the premises of a person as one stationary source, unless the dominant source of sound on those premises is construction or a conveyance, see Reference [12]. Section A.2.1.1 provides further explanation.

"Time Periods"
"Day-time"
is the 16-hour period between 07:00 and 23:00 hours.

"Evening"
is the 4-hour period between 19:00 and 23:00 hours.

"Night-time"
is the 8-hour period between 23:00 and 07:00 hours.

"Urban Hum"
means aggregate sound of many unidentifiable, mostly road traffic related sound sources.

"Warning Clause" (or "Environmental Warning/Restriction")
means a notification of or obligation to notify a potential purchaser of some environmental concern; in this case the concern is potential annoyance due a source of noise.

3. NOISE IMPACT ASSESSMENT, TRANSPORTATION SOURCES

This section deals with noise impact from transportation corridors (i.e., road, rail and air traffic). In case of multiple transportation noise sources:

(a) the outdoor noise impact due to air traffic shall be established separately from the impact due to road and/or rail traffic;
(b) the outdoor noise impact due to road and rail traffic shall be combined;
(c) the indoor noise impact shall be assessed separately for road, rail and aircraft noise. The required indoor noise control measures for the multiple source impact are then defined by a combined acoustical insulation parameter (descriptor) that is evaluated by combining the acoustical insulation parameters determined for each of the sources.

In all cases, consideration should be given to future sound levels. For road and rail noise, a minimum ten year prediction should be made and for aircraft noise, the current NEF/NEP contours shall apply.

3.1 ROAD AND RAIL TRAFFIC

3.1.1 Sound Levels

The sound levels from road and/or rail transportation at the site of a proposed noise sensitive land use shall be established using methods included in References [3] and [4]. Further details are in Section A.2 of the Annex.

3.1.2 Day-time Outdoor Sound Level Criterion

Table 1 gives the equivalent sound level (L_{eq}) criterion in the selected Outdoor Living Area. The criterion applies to the entire day-time period from 07:00 to 23:00. Section A.3.2.1 of the Annex describes the application of the criteria and the use of warning clauses.

TABLE 1
Sound Level Criterion for Outdoor Living Areas
Road and Rail

Time Period	L_{eq} (16) (dBA)
16 hr, 07:00 - 23:00	55

3.1.3 Indoor Sound Level Criteria

Table 2 gives the equivalent sound level (L_{eq}) criteria and the applicable time periods for the indicated types of indoor space. The specified sound level criteria are minimum requirements and apply to the indicated indoor spaces with the windows and doors closed.

TABLE 2
Indoor Sound Level Criteria
Road and Rail

Type of Space	L_{eq} (Time Period) (dBA)	
	Road	Rail
Living/dining areas of residences, hospitals, schools, nursing/retirement homes, day-care centres, etc. (Time period: 16 hr, 07:00 - 23:00)	45	40
Sleeping quarters (Time period: 8 hr, 23:00 - 07:00)	40	35

3.2 AIR TRAFFIC

3.2.1 Noise Impact

Policy 1.1.3 g) of Reference [13] establishes the applicable criterion. The noise impact on the proposed noise sensitive land use is determined based on the location of the noise sensitive land use with respect to the official Noise Exposure Forecast/Noise Exposure Projection (NEF/NEP) contours. These NEF/NEP contours are specified on a list of current contour maps available from the Ministry of Municipal Affairs and Housing. The more restrictive of the NEF and NEP contours apply. Further details are in Annex Section A.2.4 and Section A.3.2.1.

3.2.2 Outdoor Criterion

Table 3 gives the aircraft noise criterion in terms of an NEF/NEP value in any outdoor area, including the Outdoor Living Area. The criterion applies to the entire 24-hour period. The distance separation from the airport and, consequently, the location of the noise sensitive land use with respect to the NEF/NEP contours, is the only measure that controls the outdoor noise impact. Section A.3.2.1 of the Annex describes the application of the criterion and the use of warning clauses.

TABLE 3
Outdoor Aircraft Noise Criterion

Time Period	NEF/NEP
24 hours	30 *

* Certain conditions apply above NEF/NEP value of 25, see Section A.3.2.1. The criterion may not apply to redevelopment and infilling, see Reference [13] and Section A.3.2.1.

3.2.3 Indoor Criteria

Table 4 gives the indoor aircraft noise criteria in terms of NEF/NEP values for the indicated type of indoor space. These criteria apply to the entire 24-hour period. The specified criteria are minimum requirements and apply to the indicated indoor spaces with the windows and doors closed.

TABLE 4
Indoor Aircraft Noise Criteria *
(Applicable over 24-hour period)

Type of Space	Indoor NEF/NEP
Living/dining areas of residences, hospitals, schools, nursing/retirement homes, day-care centres, etc.	5
Sleeping Quarters	0

* The Indoor NEF/NEP values listed in Table 4 are not obtained from NEF/NEP contour maps. The values are representative of the indoor sound levels and are used as assessment criteria for the evaluation of acoustical insulation requirements, see Reference [1].

4. NOISE IMPACT ASSESSMENT, STATIONARY SOURCES (Industrial and Commercial Activities)

In comparison to noise from transportation sources, noise from stationary sources such as industrial or commercial activities is generally controlled more effectively at the source. If control measures are required to reduce the noise impact then these measures should be designed in accordance with the following principles:

(a) Noise from stationary sources is generally controllable at lower cost at the source than at the point of reception and, consequently, source mitigation is the preferred option;

(b) Cooperation between the developer and the owner of the stationary sources is highly desirable and often essential in order to achieve the required mitigation;

(c) Installation of noise control measures at the source will typically require a Certificate of Approval (Air), as specified in Section 9 of the Environmental Protection Act, Reference [6];

(d) Noise control measures aimed at the indoor environment, such as air conditioning, are usually immaterial because the criteria for stationary source sound levels apply to the plane of windows; the sound levels are estimated in the absence of the building. The use of central air conditioning may be acceptable under special circumstances, in certain types of developments, when the central air conditioning system forms an essential part of the overall building design - details are described in Section A.2.1.4;

(e) Assessment of noise impact produced by stationary sources typically involves calculation of sound emissions from the source, transmission and propagation of sound and the effect of intervening obstacles such as barriers. The calculation should account for the frequency characteristics of the noise source.

4.1 ESTABLISHMENT OF SOUND LEVELS

The sound levels anticipated on the site of a proposed noise sensitive land use shall be established in accordance with References [8], [9], [10] and [11], including all the appropriate adjustments. The assessment of noise impact shall reflect the "predictable worst case" situation, i.e. the largest difference between source sound levels and the applicable criterion.

4.2 FEASIBILITY ASSESSMENT

Initial assessment in the planning stage of the project is required in order to determine feasibility of development. An assessment of the hourly equivalent sound level, $L_{eq}(1)$, produced by the stationary source should be made at the property line of the proposed or committed noise sensitive land use, closest to the stationary source. The proponent of the development should demonstrate the feasibility of meeting the sound level criteria contained in Sections 4.4, 4.5 and 4.7 and, if necessary, specify the necessary noise control measures. References [1], [13] and [14] provide further information regarding feasibility studies.

Committed land use means a land use that has been approved by the regulatory authority but is not yet existing. The selected location should define the closest approach of the noise sensitive land use to the stationary source, and the location of highest noise impact.

4.3 CLASS 2 AREA

Aside from development in a typically Class 1 Area (urban) setting, new residential land uses may be proposed within an environment that has qualities representative of both Class 1 and Class 3 Areas. For the purposes of this document, an area having characteristics of both urban and rural environments is referred to as a Class 2 Area.

In a Class 1 Area, such as a major population centre, the background sound level is dominated by the sound of road traffic, referred to as "urban hum". In a Class 3 Area, the acoustical environment is generally made up of natural sounds typical of agricultural or wilderness areas with little or no road traffic. A Class 2 Area can be characterised by an environment generally dominated by natural sounds during the evening and night-time periods and with man made sounds during a shortened day-time period (07:00 - 19:00).

A low level "urban hum" may be audible in a Class 2 Area during the shortened day-time period (07:00 to 19:00), but would typically be absent during the evening and at night. In order to prevent adverse effects during a quieter evening background, the stationary source sound level criteria for a Class 2 Area are 5 dB more restrictive within the hours of 19:00 to 23:00.

4.4 OUTDOOR SOUND LEVEL CRITERIA

Table 5 gives the sound level criteria in terms of the hourly equivalent sound level, $L_{eq}(1)$, for an outdoor point of reception in any area amenable for use. The criteria should not be exceeded in any day-time hour.

TABLE 5
Sound Level Criteria for an Outdoor Point of Reception
Stationary Sources

Area	Time of Day	Hourly $L_{eq}(1)$ (dBA)
Class 1	07:00 - 23:00	50*
Class 2	07:00 - 19:00	50*
	19:00 - 23:00	45*

* or the minimum hourly background sound level $L_{eq}(1)$, whichever is higher.

4.5 SOUND LEVEL CRITERIA IN THE PLANE OF A WINDOW

4.5.1 Day-time

Table 6 gives the day-time hourly equivalent sound level, $L_{eq}(1)$, criteria in the plane of a window. These criteria apply to the living spaces specified in Table 2. Section A.3.1.1 of the Annex describes their application.

TABLE 6
Sound Level Criteria in the Plane of a Window
Stationary Sources

Area	Time of Day	Hourly $L_{eq}(1)$ (dBA)
Class 1	07:00 - 23:00	50*
Class 2	07:00 - 19:00	50*
	19:00 - 23:00	45*

* or the minimum hourly background sound level $L_{eq}(1)$, whichever is higher.

4.5.2 Night-time

Table 7 gives the night-time hourly equivalent sound level, $L_{eq}(1)$, criterion in the plane of a bedroom window. Section A.3.1.1 of the Annex describes the application of the criteria.

TABLE 7
Sound Level Criterion in the Plane of a Bedroom Window
Stationary Sources

Time of Day	Hourly $L_{eq}(1)$ (dBA)
23:00 - 07:00	45*

* or the minimum hourly background sound level $L_{eq}(1)$, whichever is higher.

4.6 INDOOR SOUND LEVEL CRITERIA

No criteria have been established for indoor sound levels because compliance with the plane of the window criteria, Tables 6 and 7, will, in the majority of cases, ensure that the indoor sound levels are acceptable. Nevertheless, special care must be taken when assessing the impact of sound with a special characteristic such as a dominant low frequency component.

4.7 SPECIAL SOURCES

4.7.1 Specific Impulsive Sources

For impulsive sound produced by a stationary source which is a metal working operation or a gun club, or for impulses which are infrequent, the applicable sound level criteria are specified in Section 9 of Reference [11]. Sections 12 and 13 of Reference [11] also apply. Applicable times and locations are given in Tables 5, 6 and 7.

Where Reference [11] specifies two date specific criteria, depending on when the operation of the stationary source commenced, such as the 50 dBAI or 60 dBAI criteria for metal working operations, the more stringent of the criteria, i.e. 50 dBAI in the example, is applicable.

4.7.2 Pest Control Devices

For sound from pest control devices, the applicable sound level criteria are specified in Section 10 of Reference [11]. Sections 11, 12 and 13 of Reference [11] also apply. The applicable times and locations are given in Tables 5, 6 and 7.

4.7.3 Blasting

The applicable Peak Pressure Level criterion for concussion resulting from blasting operations in a mine or a quarry is 120 dB, measured in accordance with Reference [9]. The applicable Peak Particle Velocity criterion for vibration resulting from blasting operations in a mine or a quarry is 1.00 cm/s, measured in accordance with Reference [9].

4.7.4 Additional Guidelines

Other guidelines have been drafted or are being developed for specific stationary sources such as land fill sites, snow making equipment, and other installation/equipment.

5. NOISE IMPACT ASSESSMENT, MULTIPLE SOURCES

The assessment of noise impact produced by a combination of transportation noise sources is described at the beginning of Section 3.

Where a proposed noise sensitive land use is impacted by a combination of transportation and stationary sources, the noise impact from the sources should be assessed separately using the procedures in Sections 3 and 4.

The required control measures should be evaluated individually for surface transportation, aircraft and stationary sources, for day-time and night-time periods, using procedures outlined in Sections 3 and 4. The final selection of control measures should ensure the compliance with the applicable sound level criteria of this document.

October 1997

ISBN 0-7778-4919-4 PIBS 3372E